MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

PEM0026 – TRIGONOMETRY AND GEOMETRY

(Foundation in Engineering – All sections / Groups)

10 MARCH 2016
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 5 pages.
2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working **MUST** be shown.
4. Only **NON-PROGRAMMABLE** calculator is allowed.

APPENDIX

TRIGONOMETRY IDENTITIES

$\sin^2\theta+\cos^2\theta=1$; $\sec^2\theta=1+\tan^2\theta$; $\csc^2\theta=1+\cot^2\theta$

$\sin 2\theta = 2\sin\theta\cos\theta$

$\cos 2\theta=\cos^2\theta-\sin^2\theta=2\cos^2\theta-1=1-2\sin^2\theta$

$\tan 2\theta=\dfrac{2\tan\theta}{1-\tan^2\theta}$

$\sin(A\pm B)=\sin A\cos B\pm\cos A\sin B$

$\cos(A\pm B)=\cos A\cos B\mp\sin A\sin B$

$\tan(A\pm B)=\dfrac{\tan A\pm\tan B}{1\mp\tan A\tan B}$

$2\sin A\cos B=\sin(A+B)+\sin(A-B)$

$2\cos A\cos B=\cos(A+B)+\cos(A-B)$

$2\sin A\sin B=\cos(A-B)-\cos(A+B)$

$\sin A+\sin B=2\sin\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\sin A-\sin B=2\cos\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\cos A+\cos B=2\cos\dfrac{A+B}{2}\cos\dfrac{A-B}{2}$; $\cos A-\cos B=-2\sin\dfrac{A+B}{2}\sin\dfrac{A-B}{2}$

$\sin^2\dfrac{A}{2}=\dfrac{1-\cos A}{2}$; $\cos^2\dfrac{A}{2}=\dfrac{1+\cos A}{2}$; $\tan^2\dfrac{A}{2}=\dfrac{1-\cos A}{1+\cos A}$

$\sin\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{2}}$; $\cos\dfrac{A}{2}=\pm\sqrt{\dfrac{1+\cos A}{2}}$; $\tan\dfrac{A}{2}=\pm\sqrt{\dfrac{1-\cos A}{1+\cos A}}=\dfrac{1-\cos A}{\sin A}=\dfrac{\sin A}{1+\cos A}$

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QUESTION 1 [25 marks]

a. Given that $\tan\theta > 0$ and $\sin\theta = -\frac{2}{3}$, find the exact values of $\cot\theta$ and $\cos\theta$.

[4 marks]

b. Figure below shows a trapezium **ABCDEF** whereby **CE** is an arc of circle with the center **D**. Provided **AD = 10cm**, **FE = 7cm**, and **DE = *k* cm**, $\angle FAB = \theta$.

i. Express ***k*** in term of θ.

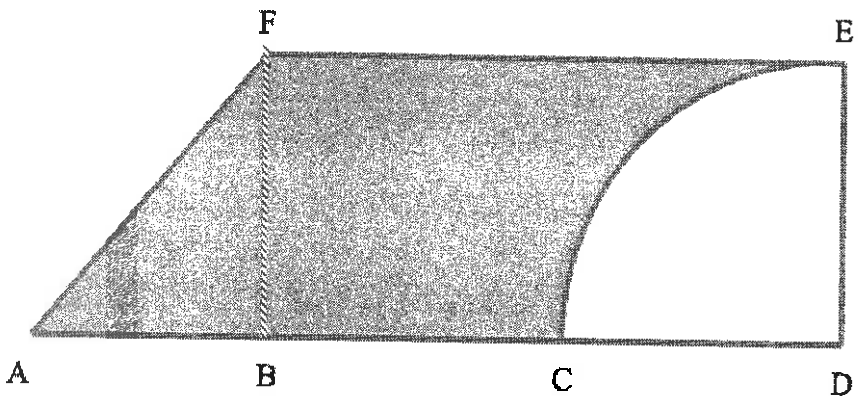
[2 marks]

ii. Express the area of the shaded region in term of θ.

[6 marks]

iii. If $\theta = 45°$, determine the area of the shaded region, round your answer to 4 decimal places.

[2 marks]



c. Provided $\tan 36° = A$, express $(\cos 54°)\left(\frac{1}{\sin 36°} - \frac{1}{\cos 36°}\right)$ in term of A.

[3 marks]

d. Given $f(x) = 2\cos(4x - \pi) + 1$.

i. Find the amplitude, period and phase shift of the function $f(x)$.

[3 marks]

ii. Sketch the graph of $f(x)$ from $\frac{\pi}{4} \le x \le \pi$.

[5 marks]

Continued...

QUESTION 2 [25 marks]

a. Verify that $4\tan(45°+\theta)-\tan(45°-\theta)=\dfrac{3\tan^2\theta+10\tan\theta+3}{1-\tan^2\theta}$. Then, solve $3\tan^2\theta+10\tan\theta+3=0$ over the interval of $0\le\theta\le360°$

[11 marks]

b. Evaluate $\sin\left(\sin^{-1}\left(-\frac{3}{5}\right)+\tan^{-1}\left(\frac{4}{3}\right)\right)$ given $\sin^{-1}\left(-\frac{3}{5}\right)$ is located at quadrant 4, and $\tan^{-1}\left(\frac{4}{3}\right)$ is located at quadrant 1.

[8 marks]

c. Verify that $\dfrac{1}{\tan x}-\dfrac{1-\tan^2 x}{2\tan x}=\csc 2x$

[6 marks]

QUESTION 3 [25 marks]

a. Two complex numbers $u=a+2i$ and $v=1+bi$ are given where a and b are real numbers. Given $uv=9-7i$, determine a and b.

[12 marks]

b. Convert the complex number $z=-2-2i$ into polar form and show the argument in degree. Then, plot the polar coordinate in the complex plane.

[8 marks]

c. Given two vectors $\mathbf{w}=\mathbf{2i}+\mathbf{j}+\mathbf{k}$ and $\mathbf{r}=\mathbf{3i}-\mathbf{2j}$, determine

i. $\mathbf{w}.\mathbf{r}$

[2 marks]

ii. $\mathbf{w}\times\mathbf{r}$

[3 marks]

Continued...

QUESTION 4 [25 marks]

a. An equation of a circle is given, $x^2-6x+y^2+8y+21=0$.

i. Determine the center of the circle.

[3 marks]

ii. Given that the gradient from center of the circle to point A(0, -2) is $-\frac{2}{3}$, determine the equation of tangent at point A

[4 marks]

b. An ellipse having center at (-1, 2), foci at $(-1-\sqrt{7},2)$ and $(-1+\sqrt{7},2)$, and minor axis 6 units long.

i. Obtain the equation of the ellipse.

[6 marks]

ii. Determine the vertices.

[2 marks]

iii. Sketch the graph.

[3 marks]

c. Given a hyperbola $\frac{(x+3)^2}{25}-\frac{(y+1)^2}{49}=1$.

i. Determine the eccentricity of the hyperbola.

[3 marks]

ii. Find the asymptotes of the hyperbola.

[4 marks]

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